



# Chunghwa Picture Tubes, Ltd.

## Technical Specification

To : **WTE**

Date : 2011/04/08

*CPT TFT-LCD*  
**CLAB 215FA01**

**ACCEPTED BY :**

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|          |                           |             |            |
|----------|---------------------------|-------------|------------|
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## 1. OVERVIEW

CLAB215FA01 is 21.5" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit. By applying 6 bit digital data, 1920×1080, 16.7M-color images are displayed on the 21.5" diagonal screen. Input power voltage is 5.0V for LCD driving. General specification is summarized in the following table:

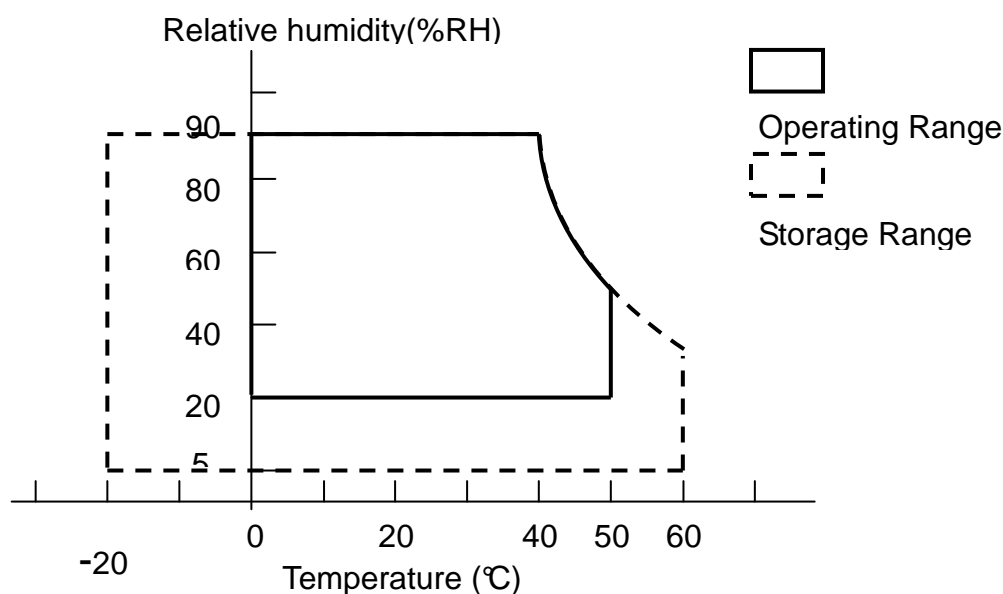
| ITEM                           | SPECIFICATION                                 |
|--------------------------------|---|
| Display Area(mm)               | 476.64 (H) × 268.11 (V) (21.53-inch diagonal) |
| Number of Pixels               | 1920 (H) × 1080(V)                            |
| Pixel Pitch(mm)                | 0.24825 (H) × 0.24825 (V)                     |
| Color Pixel Arrangement        | RGB vertical stripe                           |
| Display Mode                   | Normally white, TN                            |
| Number of Colors               | 16.7M(6bits+Hi-FRC)                           |
| Brightness(cd/m <sup>2</sup> ) | 300 cd/m <sup>2</sup> (Typ.)(center, 7.5mA)   |
| Viewing Angle(H/V)             | 170/160 (Typ.)                                |
| Surface Treatment              | Anti-glare, 3H                                |
| Power consumption(W)           | 5W (Typ)                                      |

## 2. ABSOLUTE MAXIMUM RATINGS

| ITEM                         | SYMBOL | MIN. | MAX. | UNIT | REMARK         |
|------------------------------|--------|------|------|------|----------------|
| Power Supply Voltage for LCD | VCC    | 0    | 6    | V    |                |
| Operation Temperature        | Top    | -30  | 85   | °C   | 1). 2). 3). 4) |
| Storage Temperature          | Tstg   | -40  | 100  | °C   | 1). 2). 3). 4) |

[Note]

- 1)The relative temperature and humidity range are as below sketch, 90%RHMax.( $T_a \leq 40^\circ\text{C}$ ).
- 2).The maximum wet bulb temperature  $\leq 39^\circ\text{C}$  ( $T_a > 40^\circ\text{C}$ ) and without dewing.
- 3).If you use the product in an environment which over the definition of temperature and humidity too long to effect the result of eye-etching.
- 4) Test Condition: IEC 1000-4-2 VESDt: Contact discharge to input connector; VESD<sub>C</sub>: Contact discharge to module
- 5). If you operate the product in normal temperature range, the center surface of panel should be under  $60^\circ\text{C}$ .



### 3. ELECTRICAL CHARACTERISTICS

#### (1).TFT-LCD

Ta=25°C

| ITEM                                |   | SYMBOL | MIN   | TYP  | MAX   | UNIT  | REMARK   |
|-------------------------------------|---|--------|-------|------|-------|-------|----------|
| Power Supply Voltage for LCD        |   | VCC    | 4.5   | 5.0  | 5.5   | V     | *1)      |
| Power Supply Current for LCD        |   | ICC    | --    | 1000 | 1500  | mA    | *2)      |
| Permissive Ripple Voltage for Logic |   | VRP    | --    | --   | 100   | mVp-p | VCC=5.0V |
| Differential Resistance             |   | Zm     | 90    | 100  | 110   | Ω     |          |
| LVDS:<br>IN+ , IN-                  | The same motion input Voltage             | VCM    | 1.125 | 1.25 | 1.375 | V     | *3)      |
|                                     | Differential input Voltage                | VID    | 250   | 350  | 450   | mV    |          |
|                                     | High electric potential threshold voltage | VTH    | -     | -    | 100   | mV    |          |
|                                     | Low electric potential threshold voltage  | VTL    | -100  | -    | -     | mV    |          |
| LCD Irush Current                   |   | Irush  | -     | -    | 4     | A     | *4)      |
| Power consumption                   |   | P      | -     | 5    | 7.5   | W     | *2)      |

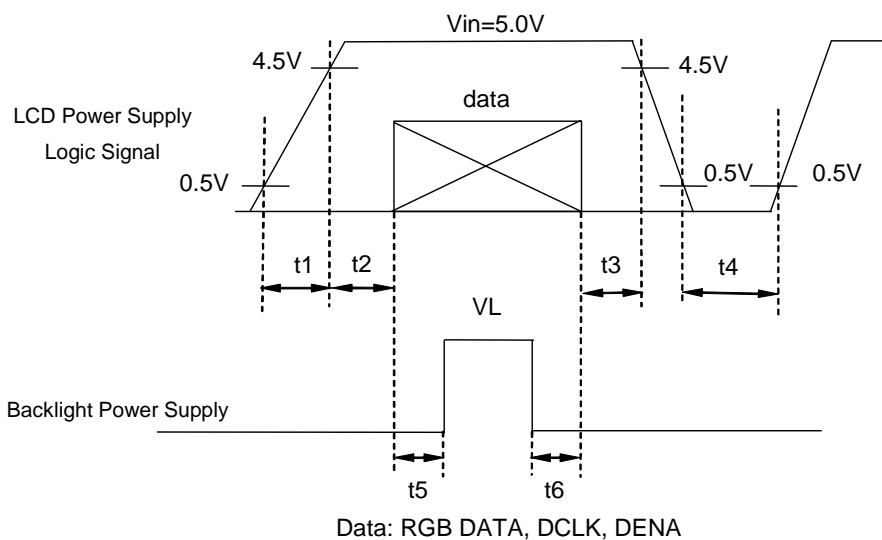
[Note]

\*1)Power 、data sequence

$$0.50\text{ms} \leq t1 \leq 10\text{ms} \quad t4 \geq 1 \text{ sec}$$

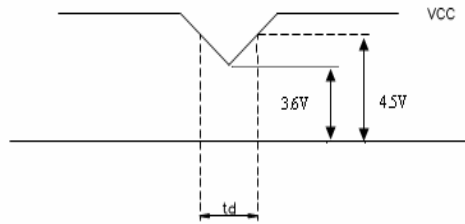
$$0.01\text{ms} < t2 \leq 50\text{ms} \quad t5 \geq 200\text{ms}$$

$$0.01\text{ms} < t3 \leq 50\text{ms} \quad t6 \geq 200\text{ms}$$



VCC-dip conditions:

- (1) When  $3.6\text{V} \leq V_{cc}(\text{min}) < 4.5\text{V}$ :  $t_d \leq 10\text{ ms}$
- (2) When  $V_{cc} < 3.6\text{ V}$ , VCC-dip conditions should also follow the VCC-turn-on conditions.

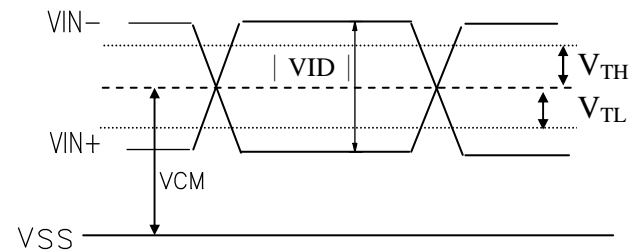
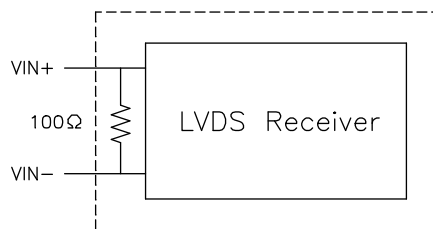


2). Typical value is measured when displaying horizontal gray scale line pattern:

64 gray level, 1920 line mode

$V_{CC}=5.0\text{ V}$  ,  $f_H= 67.8\text{ kHz}$  ,  $f_V=60\text{ Hz}$  ,  $f_{CLK}=72\text{ MHz}$

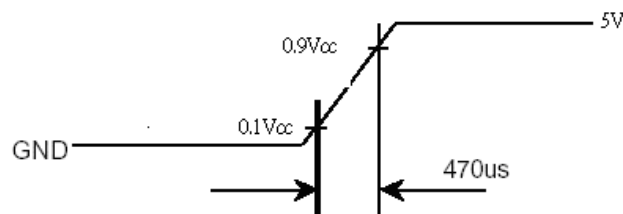
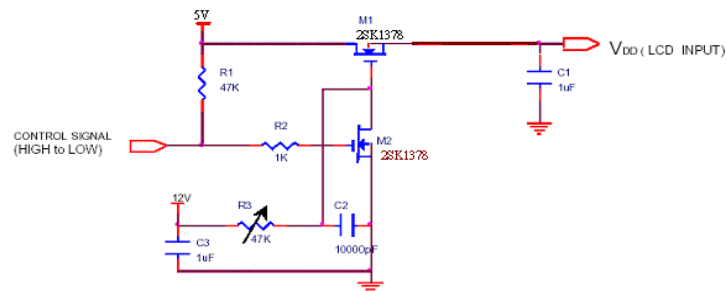
\*3) LVDS Signal definition



VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

\*4).Irush Measurement Condition



## 4. INTERFACE PIN CONNECTION

### (1) CN1

Outlet connector: GS2330-0312R-7F (FOXCONN) (or equivalent)

| PIN NO. | REMARK | FUNCTION                                  |
|---------|--------|---|
| 1       | RXO0-  | minus signal of odd channel 0(LVDS)       |
| 2       | RXO0+  | plus signal of odd channel 0(LVDS)        |
| 3       | RXO1-  | minus signal of odd channel 1(LVDS)       |
| 4       | RXO1+  | plus signal of odd channel 1(LVDS)        |
| 5       | RXO2-  | minus signal of odd channel 2(LVDS)       |
| 6       | RXO2+  | plus signal of odd channel 2(LVDS)        |
| 7       | GND    | GND                                       |
| 8       | RXOC-  | minus signal of odd clock channel (LVDS)  |
| 9       | RXOC+  | plus signal of odd clock channel (LVDS)   |
| 10      | RXO3-  | minus signal of odd channel 3(LVDS)       |
| 11      | RXO3+  | plus signal of odd channel 3(LVDS)        |
| 12      | RXE0-  | minus signal of even channel 0(LVDS)      |
| 13      | RXE0+  | plus signal of even channel 0(LVDS)       |
| 14      | GND    | GND                                       |
| 15      | RXE1-  | minus signal of even channel 1(LVDS)      |
| 16      | RXE1+  | plus signal of even channel 1(LVDS)       |
| 17      | GND    | GND                                       |
| 18      | RXE2-  | minus signal of even channel 2(LVDS)      |
| 19      | RXE2+  | plus signal of even channel 2(LVDS)       |
| 20      | RXEC-  | minus signal of even clock channel (LVDS) |
| 21      | RXEC+  | plus signal of even clock channel (LVDS)  |
| 22      | RXE3-  | minus signal of even channel 3(LVDS)      |
| 23      | RXE3+  | plus signal of even channel 3(LVDS)       |
| 24      | GND    | GND                                       |
| 25      | NC     | NC  |
| 26      | NC     | Test pin (Can't connect to GND)           |
| 27      | NC     | NC  |
| 28      | VCC    | Power supply input voltage(5.0 V)         |
| 29      | VCC    | Power supply input voltage(5.0 V)         |
| 30      | VCC    | Power supply input voltage(5.0 V)         |

1) Keep the NC Pin and don't connect it to GND or other signals.

2) GND Pin must connect to the ground, don't let it be a vacant pin.

## 5. INTERFACE TIMING

### (1) Timing Characteristic

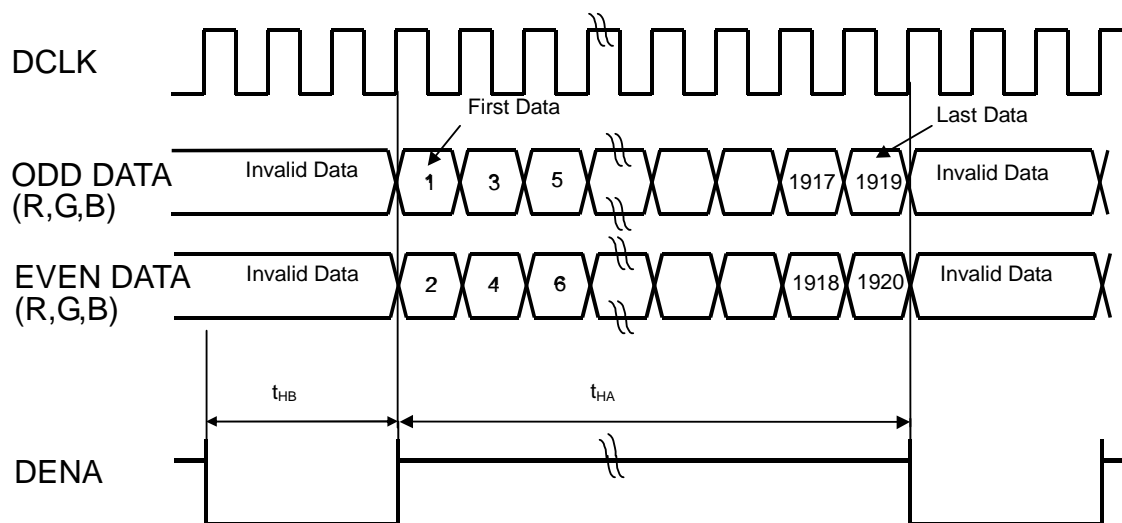
| ITEM          |      |            | SYMBOL                    | MIN.             | TYP.  | MAX.  | UNIT  |                  |
|---------------|------|------------|---------------------------|------------------|-------|-------|-------|------------------|
| LCD<br>Timing | DCLK |            | Freq.                     | f <sub>CLK</sub> | 55    | 72    | 90    | MHz              |
|               |      |            | Cycle                     | t <sub>CLK</sub> | 18.18 | 13.89 | 11.11 | ns               |
|               | DENA | Horizontal | Horizontal effective time | t <sub>HA</sub>  | 960   | 960   | 960   | t <sub>CLK</sub> |
|               |      |            | Horizontal blank time     | t <sub>HB</sub>  | 40    | 100   | 160   | t <sub>CLK</sub> |
|               |      |            | Horizontal total time     | t <sub>H</sub>   | 992   | 1060  | 1075  | t <sub>CLK</sub> |
|               |      | Vertical   | Vertical frame Rate       | Fr               | 50    | 60    | 75    | Hz               |
|               |      |            | Vertical total time       | t <sub>V</sub>   | 1084  | 1130  | 1170  | t <sub>H</sub>   |
|               |      |            | Vertical effective time   | t <sub>VA</sub>  | 1080  | 1080  | 1080  | t <sub>H</sub>   |
|               |      |            | Vertical blank time       | t <sub>VB</sub>  | 10    | 50    | 150   | t <sub>H</sub>   |

[Note]

- \*1) DENA (data enable) usually is positive
- \*2) DCLK still inputs during blanking
- \*3) LVDS transmitter IC: **HX8861-C06 (HIMAX)**
- \*4) DE mode only
- \*5) It maybe cause flicker at 50Hz.

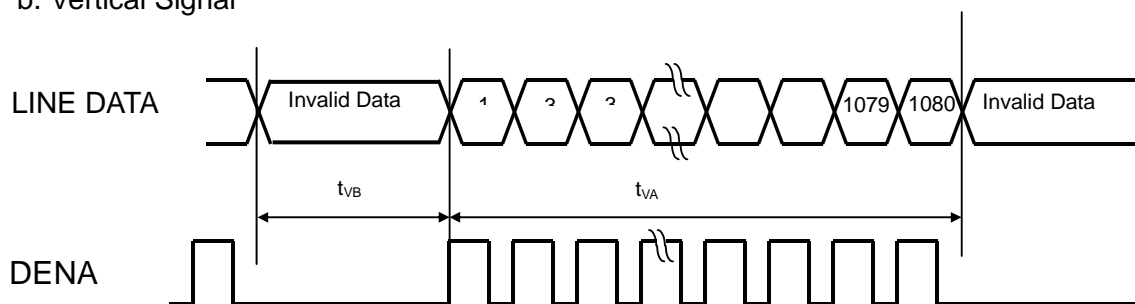
### (2).Timing Chart

#### a. Horizontal Signal



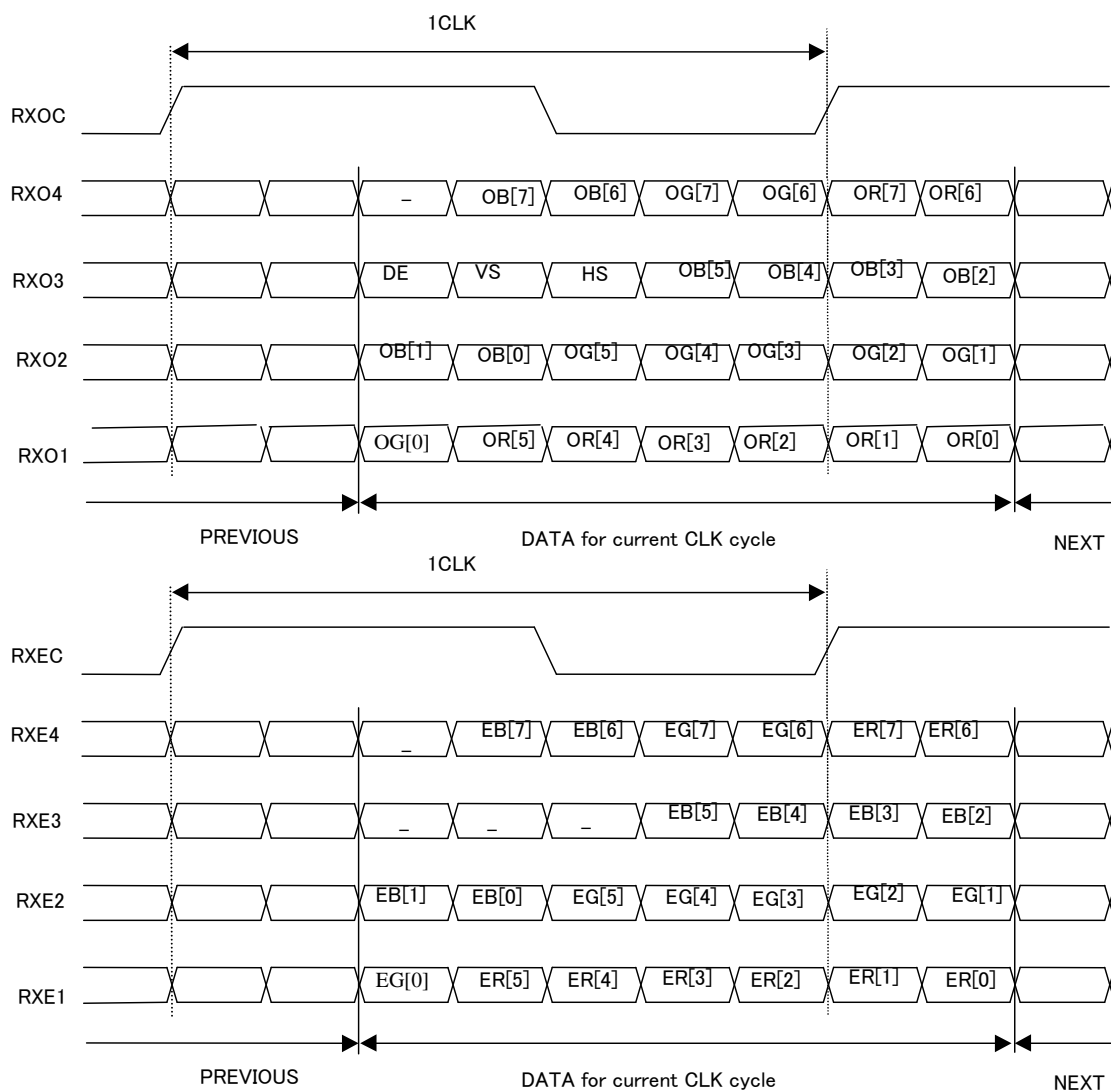


## b. Vertical Signal



## (3).LVDS Data

For 6Bit+Hi-FRC



## Color Data Assignment

| COLOR       | INPUT DATA | R DATA |    |    |    |    |    |    |     | G DATA |    |    |    |    |    |    |     | B DATA |    |    |    |    |    |    |     |
|-------------|------------|--------|----|----|----|----|----|----|-----|--------|----|----|----|----|----|----|-----|--------|----|----|----|----|----|----|-----|
|             |            | R7     | R6 | R5 | R4 | R3 | R2 | R1 | R0  | G7     | G6 | G5 | G4 | G3 | G2 | G1 | G0  | B7     | B6 | B5 | B4 | B3 | B2 | B1 | B0  |
|             |            | MSB    |    |    |    |    |    |    | LSB | MSB    |    |    |    |    |    |    | LSB | MSB    |    |    |    |    |    |    | LSB |
| BASIC COLOR | BLACK      | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(255)   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(255) | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | BLUE(255)  | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
|             | CYAN       | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
|             | MAGENTA    | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
|             | YELLOW     | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | WHITE      | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
| RED         | RED(0)     | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(1)     | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(2)     | 0      | 0  | 0  | 0  | 0  | 0  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             | RED(254)   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(255)   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| GREEN       | GREEN(0)   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(1)   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(2)   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 1  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             | GREEN(254) | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(255) | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| BLUE        | BLUE(0)    | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | BLUE(1)    | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 1  | 0   |
|             | BLUE(2)    | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 1  | 0  | 0   |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             | BLUE(254)  | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 0   |
|             | BLUE(255)  | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |

[Note] 1) Definition of gray scale: Color (n): n indicates gray scale level; higher n means brighter level.

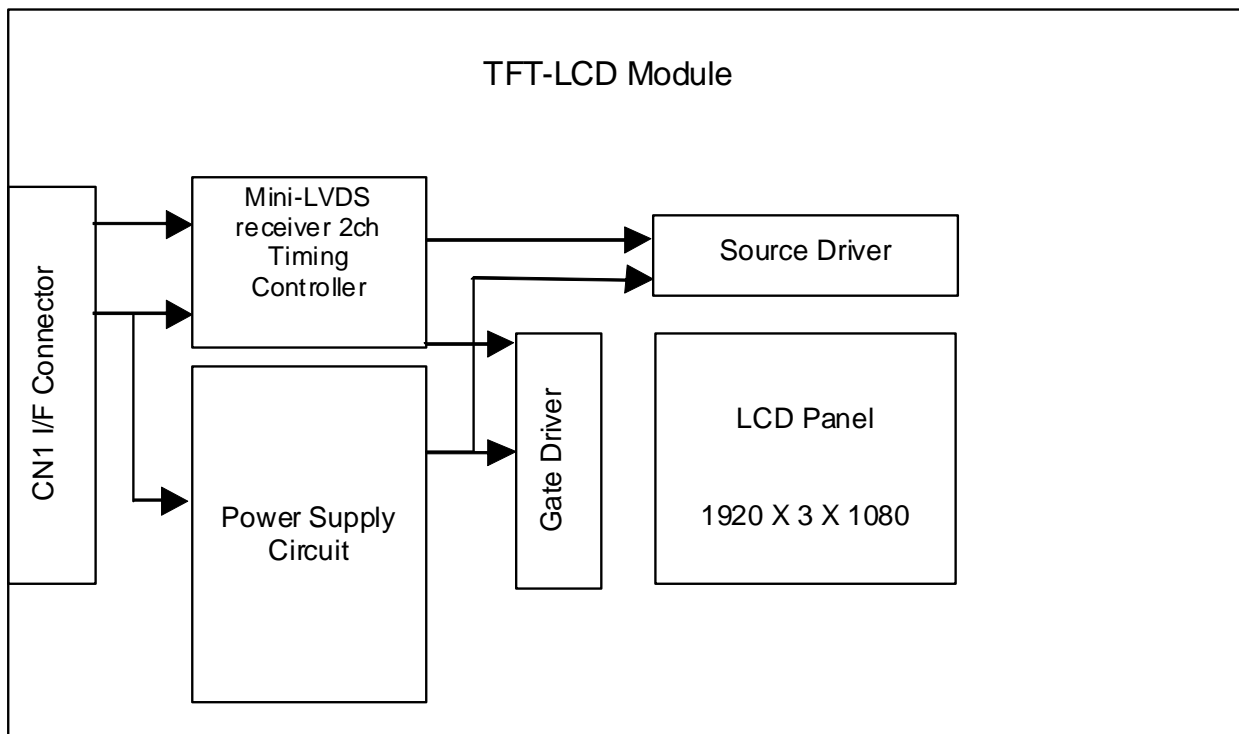
2) Data: 1-High, 0-Low.

3) For odd & even data also.

## (4).Color Data Distribution

|            |            |    |            |    |               |               |
|------------|------------|----|------------|----|---------------|---------------|
| D(1,1)     | D(2,1)     | .. | D(X,1)     | .. | D(1919,1)     | D(1920,1)     |
| D(1,2)     | D(2,2)     | .. | D(X,2)     | .. | D(1919,2)     | D(1920,2)     |
| ..         | ..         | +  | ..         | +  | ..            | ..            |
| D(1,Y)     | D(2,Y)     | .. | D(X,Y)     | .. | D(1919,Y)     | D(1920,Y)     |
| ..         | ..         | +  | ..         | +  | ..            | ..            |
| D(1,1079)  | D(2, 1079) | .. | D(X, 1079) | .. | D(1919, 1079) | D(1920, 1079) |
| D(1, 1080) | D(2, 1080) | .. | D(X, 1080) | .. | D(1919, 1080) | D(1920,1080)  |

## 6. BLOCK DIAGRAM



## 7. MECHANICAL SPECIFICATION

(1) OLB Drawing (Tolerance is  $\pm 0.5\text{mm}$  unless noted)

[Unit:mm]

